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28.02.2000 JP 2000051579(71) Applicant:
CANON KABUSHIKI KAISHA
Tokyo (JP)

(72) Inventors:

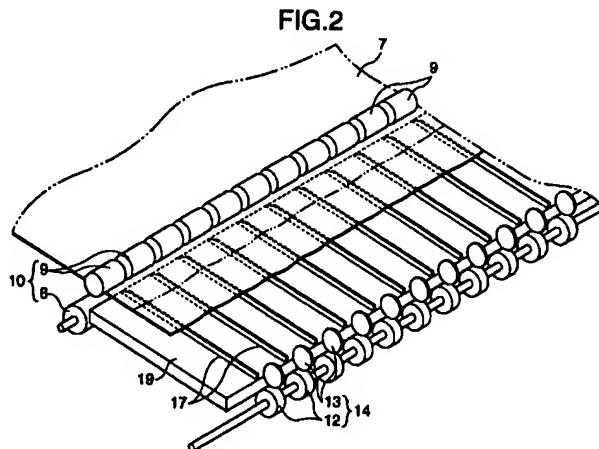
- Kida, Akira
Ohta-ku, Tokyo (JP)
- Nishiberi, Nozomu
Ohta-ku, Tokyo (JP)
- Matsumoto, Toshiya
Ohta-ku, Tokyo (JP)
- Ohyama, Kazuo
Ohta-ku, Tokyo (JP)

(74) Representative:

Pellmann, Hans-Bernd, Dipl.-Ing. et al
Patentanwaltsbüro
Tiedtke-Bühling-Kinne & Partner
Bavariaring 4-6
80336 München (DE)

(54) Ink jet recording apparatus

(57) An ink jet recording apparatus, which records with deposition of ink droplets to a recording medium by use of ink jet recording means, comprises a platen for supporting a recording medium in a position facing ink jet recording means, a plurality of carrier roller pairs for nipping and carrying the recording medium to the position of ink deposition the recording medium using the ink jet recording means and extrusions extended in the carrying direction of the recording medium with respect to the platen, at the same time, being arranged in a plurality in the direction intersecting the carrying direction of the recording medium to support the reverse side of recording medium. Here, the carrier roller pairs are positioned on each of the extended lines of the extrusions on the upstream side of the carrying direction of the recording medium. With the structure thus arranged, the floating of a recording medium from the platen can be suppressed so as to allow the gap to be formed narrower between the recording medium and recording means, hence making it possible to perform recording in higher quality.



Description**BACKGROUND OF THE INVENTION****Field of the Invention**

[0001] The present invention relates to a recording apparatus that records images, such as characters, graphics, and patterns, by depositing ink to a recording medium by use of recording means.

Related Background Art

[0002] When recording is performed by the deposition of ink droplets to a recording medium, ink is absorbed into the recording medium, and the portion where ink is thus absorbed is subjected to swelling. Then, depending on the difference in the concentration of ink that adheres to the recording medium, a portion having difference in stretching may occur. The largely stretched portion is caused to bend in the direction perpendicular to the recording surface of the recording medium of sheet type. The so-called cockling irregularities may take place. Here, the more the time elapses, the more ink droplets are absorbed into a recording medium to bring about the swelling. Thus, the irregularities become greater. When image data or the like is recorded, a technique is adopted to make the influence exerted by the uneven pitches of feeding smaller as to the quality of recorded images by making the feeding pitches of a recording medium smaller, while dividing the image data at random, so that the scanning frequency is made larger for the carriage having recording means on it to travel for recording. When the feeding pitches are smaller as in this case, the recording time becomes longer to bring about a larger cockling. As a result, during the recording operation, the recording medium tends to bend in the direction toward recording means from the platen side where the recording medium is supported to be positioned to face the recording means. In such condition, the sheet floating may take place with the result that recording means is in contact with the recording medium to rub each other, and that the quality of recorded images are degraded eventually in some cases.

[0003] For the recording apparatus that adopts the ink jet recording method whereby to record by discharging ink, the shorter the flying passage of ink, the higher becomes the accuracy in which the adhesive positions of ink are secured. For a recording apparatus of the kind, it is required to set the gap between the recording surface of a recording medium and the recording head (hereinafter referred to as a "head gap") as narrow as possible. On the other hand, if the head gap is made narrower, a rubbing of the kind as described above tends to occur more often.

[0004] Therefore, it is necessary to provide a method whereby to minimize the sheet floating that may

be caused by cockling so that no rubbing occurs between recording means and a recording medium.

[0005] As the structure to prevent the sheet floating of a recording medium from the platen, a structure (a first conventional example) is disclosed in the specifications of Japanese Patent Application Laid-Open Nos. 61-95966 and 3-29359 that a plurality of small holes are provided for the platen or suction force is allowed to act upon a recording medium through small holes by use of negative pressure generating means, thus the recording medium being held closely in contact with the platen.

[0006] Also, in the specification of Japanese Patent Application Laid-Open No. 4-69264, a mechanism (a second conventional example) is disclosed in order to press a recording medium by use of a paper pressure member arranged on the upstream side in the carrying direction of the recording medium.

[0007] Further, in the specification of Japanese Patent Application Laid-Open No. 9-48161, an ink jet recording apparatus (a third conventional example) is disclosed in which a plurality of ribs, which are extended on the flat platen in the carrying direction of a recording medium, are arranged in the direction intersecting the carrying direction of the recording medium, and then, on the upstream side of the ribs, the pressure plate is arranged to be extended in the direction intersecting the carrying direction of the recording medium in order to nip it together with each tip of the ribs. Also, for this ink jet recording apparatus, the extrusions are arranged on the respective positions of the pressure plate corresponding to each of the gaps between ribs, thus exerting the force that presses the recording medium downward.

[0008] For the first conventional example described above, there is a need for the provision of negative pressure generating means, which inevitably makes the apparatus larger, and the costs of manufacture higher as well. There is also a problem that noises become greater when the air is taken in and exhausted. Further, when recording is made on a smaller recording medium, the suction efficiency is extremely lowered to the extent that the dependability becomes inferior if the plural fine holes arranged for the platen are partly located out of the recording medium to be used, and released. If the arrangement is made so that all the fine holes cover even a smaller sized recording medium, it becomes impossible to exert the suction force all over a larger recording medium. As a result, the dependability also becomes inferior. In order to solve a problem of the kind, it is necessary to provide means for closing the fine holes that may be located out of a smaller sized recording medium. Then, the structure becomes considerably complicated to make the costs of manufacture higher.

[0009] For the second conventional example, there is a possibility that a recording medium is not sufficiently pressed closely to the platen if the recording area is wide. In other words, the recording medium is pressed

by the paper pressure member to the platen on the upstream side, while being nipped by the sheet exhaust roller or the like on the downstream side. However, the recording medium is not pressed at all on the recording area or the like which exists between these sides. As a result, if the recording area is wide so that one line portion of the recording head should become wider, there is a fear that the recording medium is caused to float from the platen or the cockling takes place on the recording medium on the recording area only with the depression exerted by the paper pressure member on the upstream side and by the exhaust rollers on the downstream side. Further, in order to suppress the paper sheet floating, if the nipping portion of the exhaust roller pair is positioned lower than the guiding surface of the platen for a recording medium, there is a problem encountered that the trailing end of the recording medium is allowed to float after the recording sheet is placed away from the paper pressure member.

[0010] For the third conventional example, the paper pressure plate is arranged without any exception on the position that is substantially in contact with each leading end of the ribs on the upstream side thereof. However, it is impossible to exert any force to press the recording medium to the platen side by the nipping portion of the recording medium by each of the leading ends of ribs and the paper pressure plate. Also, there is a problem that the ribs, which are set on the lower face of the paper pressure plate arranged in the gap between each of the ribs adjacent to each other on the upstream, cannot prevent the floating of a recording medium from the platen completely in a case where a comparatively robust recording medium, such as cardboard, is carried or recording is performed on a wide recording area, although there is an effect that the recording medium is pressed in the direction of the platen when the recording medium is placed in a position between ribs.

SUMMARY OF THE INVENTION

[0011] The present invention is designed with a view to solving the problems discussed above. It is an object of the invention to provide an ink jet recording apparatus capable of preventing a recording medium from floating toward recording means with a simple structure at lower costs.

[0012] Also, it is another object of the invention to provide an ink jet recording apparatus, which records with deposition of ink droplets to a recording medium by use of ink jet recording means, comprises a platen for supporting a recording medium in a position facing ink jet recording means; a plurality of carrier roller pairs for nipping and carrying the recording medium to the position of ink deposition the recording medium using the ink jet recording means; and extrusions extended in the carrying direction of the recording medium with respect to the platen, at the same time, being arranged in a plu-

rality in the direction intersecting the carrying direction of the recording medium to support the reverse side of recording medium. Here, the carrier roller pairs are positioned on each of the extended lines of the extrusions on the upstream side of the carrying direction of the recording medium.

[0013] It is still another object of the invention to provide an ink jet recording apparatus, which is provided with a carrier roller unit having a plurality of roller pairs arranged on the upstream side of the recording area, and a platen arranged on the downstream side of the carrier roller unit for supporting a recording medium in a position facing recording means, comprises the nipping portions of the carrier roller unit for nipping the recording medium by use of a plurality of the roller pairs thereof, and non-nipping portions; a plurality of ribs arranged for the platen, and positioned on the extended lines of the nipping portions in the carrying direction of the recording medium, and extended in the carrying direction of the recording medium; and a standard position for carrying a recording medium capable of aligning one edge portion of the recording medium irrespective of the sizes of the recording medium. Here, one of the plurality of ribs is arranged in a position inside the other edge of the recording apparatus of regular size by 1 mm to 10 mm.

[0014] Other objectives and advantages besides those discussed above will be apparent to those skilled in the art from the description of a preferred embodiment of the invention which follows. In the description, reference is made to accompanying drawings, which form a part hereof, and which illustrate an example of the invention. Such example, however, is not exhaustive of the various embodiments of the invention, and therefore reference is made to the claims which follow the description for determining the scope of the invention.

BRIEF DESCRIPTION OF THE DRAWINGS

[0015]

Fig. 1 is a cross-sectional view which shows the circumference of recording means of a recording apparatus in accordance with a first embodiment of the present invention.

Fig. 2 is a perspective view which schematically shows the circumference of recording means of a recording apparatus in accordance with a first embodiment of the present invention.

Fig 3 is a view which schematically shows the state of a recording medium before recording operation, observed in the direction indicated by an arrow A in Fig. 1.

Fig 4 is a view which schematically shows the state of a recording medium after recording operation, observed in the direction indicated by an arrow A in Fig. 1.

Fig. 5 is a perspective view which shows schemati-

cally the circumference of recording means of a recording apparatus in accordance with a second embodiment of the present invention.

Fig. 6 is a cross-sectional view which shows schematically the circumference of recording means of a recording apparatus in accordance with a third embodiment of the present invention.

Fig. 7 is a perspective view which shows schematically the circumference of recording means of a recording apparatus in accordance with the third embodiment of the present invention.

Fig. 8 is a view which shows schematically the state where a recording medium is in contact only with longer ribs, observed in the direction indicated by an arrow A in Fig. 6.

Fig. 9 is a view which shows schematically the state where a recording medium is in contact only with shorter ribs, observed in the direction indicated by an arrow A in Fig. 6.

Fig. 10 is a view which shows schematically the state where cockling occurs on a recording medium after recording, observed in the direction indicated by an arrow A in Fig. 6.

Fig. 11 is a plan view which shows the circumference of a recording area in accordance with the third embodiment of the present invention.

Fig. 12 is a cross-sectional view which shows the circumference of a recording area in accordance with a fourth embodiment of the present invention.

Fig. 13 is a cross-sectional view which shows the circumference of a recording area in accordance with a fifth embodiment of the present invention.

Fig. 14 is a perspective view which shows schematically the circumference of a recording area in accordance with the fifth embodiment of the present invention.

DETAILED DESCRIPTION OF THE PREFERRED EMBODIMENTS

[0016] Hereinafter, with reference to the accompanying drawings, the description will be made of the embodiments in accordance with the present invention.

(First Embodiment)

[0017] Fig. 1 is a cross-sectional view which shows the circumference of the recording area of a recording apparatus in accordance with a first embodiment of the present invention. Fig. 2 is a perspective view which schematically shows the circumference thereof.

[0018] As shown in Fig. 1, the recording apparatus of the present embodiment is provided with the recording head 1 of ink jet recording type that records images or the like with the deposition of ink droplets discharged to a recording medium.

[0019] At first, the description will be made of the scanning mechanism of recording means. The record-

ing head 1 is detachably mounted on a carriage 2. The carriage 2 is slidably supported on a guide rail 3, and the guide roller 4 which is protruded from the carriage 2 is rotatively supported on a supporting rail 5. Then, being driven by a carriage motor (not shown) through a timing belt 6, the carriage 2 scans along the guide rail 3 and the supporting rail 5. In synchronism with the scanning of the carriage 2, ink droplets are discharged from the recording head 1 mounted on the carriage 2 to the specific positions on a recording medium 7 for recording images or the like on it.

[0020] Now, the carrying mechanism for the recording medium 7 will be described. On the upstream side of the carrying path of the recording head 1, there is arranged a pair of carrier rollers 10 comprising the upstream side carrier roller 8 which is driven by a motor (not shown) and the driven roller 9 which is pressed to the upstream side carrier roller 8 by means of a biasing spring 11 to rotate following the rotation thereof. The rotational center of the driven roller 9 is placed in a position slightly deviated to the downstream side in the carrying direction than the rotational center of the upstream side carrier roller 8. Therefore, the carrier roller pair 10 send out the recording medium 7 diagonally downward, while pressing it to the platen 19. In other words, the driven roller 9 functions as a pressure roller that presses the recording medium 7 to the platen 19. For the present embodiment, if the structure is arranged so that each of the driven rollers 9 is individually biased by means of the biasing spring 11, it becomes possible to press the recording medium 7 appropriately in accordance with the amount of deformation of each portion thereof.

[0021] The platen 19 is arranged to face the recording head 1. Then, on the guiding surface for the recording medium 7, a plurality of extrusive ribs 17, each extruded in the carrying direction, are arranged in line in the direction intersecting the carrying direction. A plurality of driven rollers 9 are arranged corresponding to these ribs 17, and the central position of the driven rollers 9 in the direction of the rotational axis, and the central position of the ribs 17 are arranged to be on one and the same line in the carrying direction.

[0022] On the downstream side of the recording head 1 on the carrying path, there are arranged the sheet exhaust roller pairs 14 which comprise the downstream side carrier rollers 12 driven by a motor (not shown), and the spurs 13 serving as the rotational devices used for sheet exhaust which are biased by means of biasing spring 15 to rotate following the rotation of the downstream side rollers 12. Each of the spurs 13 has a small contact area with the recording medium 7 so that recorded images are not spoiled even when the spurs are in contact with the recording surface thereof after recording. Each of the sheet exhaust roller pairs 14 is provided with a nipping portion to nip the recording medium 7, and the portion which is not in contact with the recording medium (non-nipping portion)

alternately in the direction intersecting the carrying direction of the recording medium. Then, these portions are positioned to arrange the nipping portions and the vertices of the ribs 17 to be on one and same straight line in the carrying direction. On the upstream side of the ribs 17 in the carrying direction, the nipping portions are positioned without any exception.

[0023] Now, the description will be made of the recording operation of the recording apparatus.

[0024] By the sheet feeding mechanism which is not shown, the recording medium 7 is carried to the nipping portion of the carrier roller pair 10. Then, by the rotation of the carrier roller pair 10, the recording medium is carried on the platen 19 to the recording position that faces the recording head 1. The recording head 1 is guided to the recording position by the scanning of the carriage 2 where the recording operation is carried out for the deposition of ink onto the recording medium 7. During the recording operation, the carrier roller pair 10 carries the recording sheet 7 at specific pitches. Then, when the recording medium 7 reaches the sheet exhaust roller pair 14 by means of sheet feeding, the sheet is carried by the cooperation of the sheet exhaust roller pair 14 and the carrier roller pair 10. After the trailing end of the recording medium 7 leaves the carrier roller pair 10, the sheet is carried only by the sheet exhaust roller pair 14. When the recording operation is completed, the sheet exhaust roller pair 14 sends out the recording medium 7 onto the exhausted sheet tray which is not shown.

[0025] Now, in conjunction with Fig. 3 and Fig. 4, the description will be made of the behavior of the recording medium 7 before and after the recording operation on assumption that the ordinary paper sheet is used, which is a thinner recording medium subjected to the occurrence of cockling in particular. Fig. 3 and Fig. 4 are views observed in the direction indicated by an arrow A in Fig. 1. Fig. 3 shows the state of the ordinary paper sheet before recording. Fig. 4 shows the state where cockling occurs on the ordinary paper sheet after recording.

[0026] The recording medium 7 is carried, while being pressed by the driven rollers 9 from diagonally above to the platen 19. In other words, since each rotational center of the driven rollers 9 is placed in the position deviated to the downstream side of each rotational center of the upstream side carrier rollers 8, the pressure exerted by the driven rollers 9 is not absorbed only by the upstream side carrier rollers 8. Thus, the pressure also acts upon in the direction in which the recording medium 7 is pressed to the platen 19. In this manner, the recording medium 7 which abuts against the platen 19 diagonally is caused to bend between the contact surfaces of the carrier roller pairs 10 and the platen 19. As a result, the biasing force is exerted to press the recording medium 7 to the platen 19. This biasing force is obtainable most effectively by arranging the center of each rib 17 and that of the rotational posi-

tion of the driven rollers 9 in the rotational direction thereof on one and same straight line in the carrying direction of the recording medium 7. However, the substantially equal biasing force may be obtainable at least by arranging each of the driven rollers 9, which corresponds to the width of the driven roller 9, in the area of each rib 17 on the upstream of the carrying direction of the recording medium 7 without exception. The recording medium 7 thus pressed to the platen 19 abuts against the ribs 17 to be bent and recessed between ribs 17. Then, as shown in Fig. 3, the recording medium is deformed to present moderate corrugation with the contacted surface with ribs 17 as the vertices thereof.

[0027] Now, when the recording ink whose main solvent is water adheres to the recording medium 7 by use of the recording head 1, the recording medium 7 swells by the absorption of water to bring about the occurrence of cockling. Here, on the contacted surface between the recording medium 7 and each of the ribs 17, the sheet floating does not easily take place due to the pressure exerted thereon. On the other hand, each portion where the recording medium 7 is not in contact with the platen 19, that is, each portion between the ribs 17, the deformation (cockling) occurs on the platen side which is the deforming direction of the recording medium 7 before recording. In other words, the waving amount X of the recording medium 7 before recording changes into the waving amount $X + \Delta X$ after recording. In this way, it is possible to absorb the swelling deformation of the recording medium 7 almost completely by the concave bending thereof between ribs 17. Also, due to the presence of ribs 17, the recording medium 7 tends to create the wavy deformation in the direction perpendicular to the carrying direction thereof, but the deformation is not easily caused in the carrying direction. Hence, in accordance with the present embodiment, the deformation caused by the swelling of the recording medium 7 is absorbed by the increased amount of the wavy deformation directed toward the platen 19 side. As a result, it becomes possible to suppress the sheet floating toward the recording head 1 side. With the suppression of the sheet floating, the contact between the recording medium 7 and the recording head 1 is controlled so as to suppress the occurrence of the unfavorable influence to the recorded images.

[0028] In this respect, each of the sheet exhaust roller pairs 14 is structured to nip only the vertices of the wavy deformation of the recording medium 7, that is, to nip only the portions positioned at the vertices of the ribs 17. As a result, there is no possibility that the deformation of the recording medium 7 is corrected, and that the effect produced by the wavy deformation of the recording medium 7 described above is not spoiled. Also, after the carrier roller pairs 10 leave the recording medium 7, the sheet floating can be suppressed due to the fact that the recording medium 7 is no longer pressed by the sheet exhaust roller pairs 14 to the platen 17.

[0029] In accordance with the present embodiment, it becomes possible to narrow the gap between the recording head 1 and the platen 19 (head gap), because the sheet floating can be suppressed. Particularly when the recording head 1 of ink jet recording type is used, the distance of the flight of discharged ink is made smaller by narrowing the head gap, hence providing a high quality recording apparatus which presents highly precise positions of ink deposition.

(Second Embodiment)

[0030] In conjunction with Fig. 5, the description will be made of a recording apparatus in accordance with a second embodiment of the present invention. In Fig. 5, the same reference marks are applied to the same parts as those in the first embodiment, and the description thereof will be omitted.

[0031] In Fig. 5, each of the carrier roller pairs 10 is formed by the upstream side carrier rollers 8, and the driven roller unit 9' which is provided with a plurality of irregular shapes in the direction of axial rotation. Then, the arrangement is made so as to position the ribs 17, and almost the central location of extruded portions of the driven roller unit 9' in the direction of the axial rotation to be on one and the same straight line in the carrying direction. Then, particularly, on each extended line of ribs 17 on the upstream in the carrying direction, the nipping portion, which formed by each driven roller 9 and carrier roller 8, is positioned without exception.

[0032] Here, by use of the driven roller unit 9' each having a plurality of the same driven rollers 9 as the first embodiment, which are connected by the shaft 20, respectively, it becomes possible to reduce the number of parts, such as the roller supporting mechanism, the biasing spring, and form a simpler structure to reduce the costs of manufacture accordingly. For the present embodiment, three driven rollers 9 are connected by the shaft 20 each to form the driven roller unit 9', respectively.

[0033] As described above, in accordance with the first and second embodiments, a recording medium is corrugated during the recording operation, and pressed to the platen, so as to absorb, with the increased amount of such corrugation, the cockling that may be created by the swelling of the recording medium by the absorption of ink, hence suppressing the sheet floating. Further, since the recording medium which is deformed to present corrugation is not easily deformed in the carrying direction thereof, the trailing end of the recording medium does not float easily even if the recording medium is pressed to the platen by the sheet exhaust roller pairs. With the suppression of the sheet floating, it is possible to narrow the gap between the recording surface of the recording medium and recording means to implement recording in higher quality.

[0034] Also, it becomes possible to suppress the sheet floating without increasing the number of parts,

which produces favorable effect in terms of manufacturing costs.

(Third Embodiment)

[0035] Now, the description will be made of a recording apparatus in accordance with a third embodiment of the present invention. Here, Fig. 6 is a cross-sectional view which shows the circumference of the recording area thereof. Fig. 7 is a perspective view which schematically shows it.

[0036] Difference between the first and second embodiments which have been described above and the third to fifth embodiments which will be described hereinafter is the provision of additional ribs 18 to the ribs 17. In the following descriptions, therefore, the same reference marks are applied to those structures which are shared by the first and second embodiments.

[0037] At first, the structure around the recording area will be described. As shown in Fig. 6 and Fig. 7, the platen 19 is arranged in the facing position of the recording head 1 to guide and support a recording medium 7. For the platen 19, a plurality of ribs 17 and 18 are arranged as extrusions extended in the carrying direction of the recording medium 7, which are formed respectively on the extended lines on the downstream side of a plurality of nipping portions of the carrier roller unit 10. The ribs 17 and the ribs 18 are different in the lengths thereof. The shorter ribs 18 originate from the points set more on the downstream side in the carrying direction as compared with the longer ribs 17, respectively.

[0038] On the downstream side of the recording area of the recording head 1, the sheet exhaust roller unit 14, formed by sheet exhaust rollers 12 and spurs 13 which are pressed by biasing springs 15 to the sheet exhaust rollers 12 to rotate following the rotation thereof, respectively, is arranged to exhaust the recording medium 7 to a sheet exhaust tray (not shown) after the passage of the recording area. With a small contact area with the recording medium 7, the spur 13 is formed not to disturb the recorded images on the recording medium when it is in contact with the recording surface thereof after recording. The nipping portions of the sheet exhaust roller unit 14 are arranged almost downstream side of the extended lines of the ribs 17 and 18, and the carrier roller unit 10. Particularly, on the extended lines on the upstream in the carrying direction of the ribs 17 and 18, the nipping portions of the carrier roller unit 10 are arranged without exception.

[0039] Now, the description will be made of the recording operation of the recording apparatus. By the sheet feeding mechanism which is not shown, a recording medium 7 is carried to the nipping portion between the carrier roller 8 and the driven toller 9 of each carrier roller unit 10. Then, after inclination and others are corrected, the recording medium 7 is carried by the rotation of the carrier roller 8 and the driven roller 9 of each car-

rier roller unit 10 to the recording area of the recording head 1.

[0040] In the recording area, the transfer of the recording medium 7 is once suspended. During this period, the carriage 2 scans along the guide rail 3 and the supporting rail 5. Then, in synchronism with the scanning of the carriage 2, the one-line portion recording is performed by discharging ink droplets from the recording head 1 mounted on the carriage 2 to specific positions on the recording medium. When the scanning and recording are completed for one-line portion, the recording medium 7 is carried by one line portion by use of the carrier roller unit 10. Then, the transfer of the recording medium 7 is suspended again, and the one-line portion scanning of the carriage 2 and recording by the recording 1 are performed. In this manner, the recording medium 7 is carried and recording by the recording head 1 are conducted alternately to record on the entire recording surface of the recording medium 7.

[0041] In this respect, when the leading end of the recording medium 7 reaches each nipping portion between the sheet exhaust roller 12 and spur 13 of the sheet exhaust roller unit 14, the recording medium 7 is carried by the rotation of each sheet exhaust roller 12 and spur 13 of the sheet exhaust roller unit 14 in addition to the rotation of each carrier roller 8 and driven roller 9 of the carrier roller unit 10. Further, when the trailing end of the recording medium 7 leaves each carrier roller 8 and driven roller 9 of the carrier roller unit 10, the recording medium 7 is carried only by the rotation of each sheet exhaust roller 12 and spur 13 of the sheet exhaust roller unit 14.

[0042] With the completion of recording to the entire recording surface of the recording medium 7 as described above, the recording medium 7 is exhausted after recording by the sheet exhaust roller unit 14 to the sheet exhaust tray which is not shown.

[0043] Now, with reference to Fig. 7 to Fig. 10, the description will be made of the behavior of the recording medium 7 before and after the recording operation on assumption that the ordinary paper sheet is used, which is a thinner recording medium subjected to the occurrence of cockling in particular.

[0044] As shown in Fig. 7 and Fig. 8, since the rotational center of each driven roller 9 is deviated from the rotational center of each carrier roller 8 to the downstream side in the carrying direction, the ordinary paper sheet (recording medium) 7 is carried, while being pressed by the ribs 17 to the platen 19. In other words, since each rotational center of the driven rollers 9 is deviated, the pressure exerted by the driven rollers 9 is not only absorbed by each carrier roller 8, but also, it acts in the direction toward the platen 19. In this manner, the recording medium 7 is carried, while being pressed downward diagonally. Here, as shown in Fig. 8, the ordinary paper sheet 7 is placed along the ribs 17, and at the same time, it forms the recessed form by the biasing force exerted between the ribs 17, hence provid-

ing the moderately corrugated shape as indicated by two-dot chain line at 70 in Fig. 7.

[0045] When the ordinary paper sheet is further carried, each portion which is corrugated between ribs 17 (the leading end of the ordinary paper sheet 7) abuts against each of the ribs 18 to be pushed upward. Then, as shown in Fig. 9, the corrugated shape is formed with the ribs 17 and 18 as the vertices thereof. In accordance with the present embodiment, each originating point of the ribs 18 is positioned more on the down stream than each originating point of the ribs 17 in the carrying direction. Therefore, the pressure, which is exerted by the carrier roller unit 10 to press the ordinary paper sheet (recording medium) 7 in the direction toward the platen 19, can be kept longer more to the downstream side (the amount of corrugation at this time is indicated by X in Fig. 9).

[0046] Then, when the recording ink whose main solvent is water adheres to the ordinary paper sheet 7 by use of the recording head 1, the ordinary paper sheet 7 swells by the absorption of water to bring about the occurrence of cockling as shown in Fig. 10. In accordance with the present embodiment, since the ribs 17 and 18 are arranged on the extended lines on the downstream side of the driven rollers 9, the portions nipped by the carrier roller unit 10 securely are pressed to the ribs 17 and 18. As a result, even if a greater deformation is made by swelling, most of such deformation is absorbed by the increased amount of bending to the platen side between ribs 17 and 18. In other words, the ordinary paper sheet 7 is recessed in the form of corrugation in advance between the ribs 17 and 18 on the platen 19, and the pressure, which is exerted by the carrier roller unit 10 to press the ordinary paper sheet 7 to the ribs 17 and 18, is maintained after the occurrence of swelling. As a result, the cockling takes place downward as shown in Fig. 10 to enable the recording sheet 7 to form between the ribs 17 and 18 the recessed portion of the corrugated amount indicated by (X + ΔX) in Fig. 10, respectively, hence making it possible to prevent the recording sheet from floating to the recording head 1 side.

[0047] Then, the ordinary paper sheet 7 having the cockling which has taken place in the recording area is carried to the sheet exhaust tray which is not shown by use of the sheet exhaust roller unit 14. However, since the sheet exhaust roller unit 14 is arranged substantially on the one and same straight lines in the carrying direction along the ribs 17 and 18, there is no possibility that the moderate corrugation formed for the sheet in the recording area and the irregularities provided therefor by cockling are allowed to change.

[0048] For a recording apparatus, the size of the recording medium (recording sheet) to be used is usually predetermined to a certain extent. For example, it is assumed that the general printer or the like uses either one of recording media, such as postcard, B5, A4, LTR (letter size), B4, LDR (leisure size), and A3. Here, there-

fore, in accordance with the present embodiment, the ribs 17 and 18 are positioned to be placed inside 1 mm to 10 mm of the side end portions of a recording medium depending on each size of the recording medium to be used. More specifically, as shown in Fig. 11, the standard position 50 is defined for carrying each medium. Then, it is arranged to align one edge portion of a recording medium 7 with this standard portion 50 for carrying the medium. The ribs 17 and 18 are arranged inside approximately 1 mm to 10 mm of the predetermined position of the other edge portion of the recording medium 7 of each size. For the portions other than those predetermined ones, a plurality of ribs 17 or 18 are arranged so that these ribs are set regularly to a certain extent. Here, as described earlier, the carrier roller unit 10 and the sheet exhaust roller unit 14 are arranged substantially on the extended lines of all the ribs 17 or ribs 18 in the carrying direction.

[0049] With the structure thus arranged, a recording medium 7 is carried with the side ends thereof placed along the ribs 17 or ribs 18, and further, carried while being nipped by the sheet exhaust roller unit 14 on the downstream side. As a result, it becomes possible to prevent the recording sheet 7 from floating to the recording head 1 side more reliably on the side end portions thereof.

(Fourth Embodiment)

[0050] Now, in conjunction with Fig. 12, the description will be made of a fourth embodiment in accordance with the present invention. Fig. 12 is a cross-sectional view which shows the circumference of the recording area of a recording apparatus. The same reference marks are applied to the structures which are the same as those appearing in the third embodiment. Then, the description thereof will be omitted.

[0051] As shown in Fig. 6, it is arranged in the third embodiment that each rotational center of the sheet exhaust rollers 12 and that of the spurs 13 are overlapped each other. In accordance with the fourth embodiment, however, each spur 21 is arranged to be in the position where the rotational center thereof is deviated more upstream of each rotational center of the sheet exhaust rollers 22 in the carrying direction. As a result, even after the trailing end of the recording medium 7 has passed the carrier roller unit 10, the recording medium is pressed by the spurs 21 toward the ribs 17 and 18 to prevent it from floating to the recording head 1 side.

(Fifth Embodiment)

[0052] Now, in conjunction with Fig. 13 and Fig. 14, the description will be made of a fifth embodiment in accordance with the present invention. Fig. 13 is a cross-sectional view which shows the circumference of the recording area of a recording apparatus. Fig. 14 is a

schematic perspective view thereof. Here, the same reference marks are applied to the structures which are the same as those appearing in the third embodiment. Therefore, the description thereof will be omitted.

[0053] As shown in Fig. 13, two sheet exhaust roller units 14 and 26 are provided for the present embodiment. In other words, as in the third embodiment, the sheet exhaust roller unit 14, which is formed by the sheet exhaust roller 12 and the spur 13 which is pressed to the sheet exhaust roller 12 by use of the biasing spring 15 to rotate following the rotation thereof. Then, there is arranged for the present embodiment, the second row sheet exhaust roller unit 26, which is formed by the second row sheet exhaust roller 25 and the second row spur 24 pressed to the second row sheet exhaust roller 25 by use of the biasing spring 27.

[0054] The second row spurs 24 and second row sheet exhaust rollers 25 of the second row sheet exhaust roller unit 26 are the same as those of the sheet exhaust roller unit 14, and are arranged on one and the same straight lines of the ribs 17 and 18 in the carrying direction of the recording medium 7. As a result, there is no possibility that the moderate corrugation formed in the recording area, and the irregularities produced by cockling are allowed to change. Further, since the sheet exhaust roller units are arranged in two rows, it becomes possible to minimize the motion of the trailing end (the portion still resides in the recording area) of the recording medium 7 to float from the platen side to the recording head side by reaction even when the leading end of the recording media 7, which is exhausted (that is, the portion that has already left each nipping position of the sheet exhaust roller unit), is in a state where the leading portion thereof hangs downward by the weight thereof, that is, it is in the so-called bowing condition. In this manner, it is possible to prevent the recording medium 7 from floating to the recording head 1 side.

[0055] Also, as shown in Fig. 14, it may be possible to make the number of rollers and nipping portions smaller for the second row sheet exhaust roller unit 26 than those of the first row sheet exhaust roller unit 14. In this case, it may be possible to arrange, between each of the nipping portions of the adjacent rollers and nipping portions, the rings 28 each having a smaller diameter than that of the second row sheet exhaust roller 25. With the provision of such rings 28, it becomes possible to maintain securely the positions of the vertices of extrusions formed by corrugation or cockling of the recording medium 7 in the second row sheet exhaust

roller unit 26. In this respect, as in the fourth embodiment, it may be possible to arrange the spurs to be in the positions where each rotational center of the spurs is deviated from each rotational center of the carrier rollers more in the upstream in the carrying direction. In this case, the recording medium 7 is pressed to the ribs 17 and 18, hence preventing it from floating to the recording head 1 side more reliably.

[0056] In accordance with the third to fifth embodi-

ments, it is possible to suppress the floating of a recording medium, because ribs are arranged for the platen by use of the carrier roller unit on the extended lines of the nipping portions as described above.

[0057] Further, the two kinds of ribs having different lengths are provided, and the originating points thereof are changed alternately and arranged on the upstream side of the respective carrying directions. In this manner, the pressure is increased to press a recording medium on the ribs whose originating points are on the downstream side to make the preventive effect against the sheet floating more reliable. Then, with the pressure thus exerted, the recording medium is corrugated in advance, such as having extrusions on the portions where the recording medium is in contact with ribs, and recesses on the portions where it is placed between ribs. As a result, the cockling that may occur on the recording medium is absorbed by the increased amount of deformation of the recessed portions, hence making it rare for cockling to cause the recording sheet to float.

[0058] Also, by arranging the driven rollers of the carrier roller unit to be deviated from each rotational center of the carrier rollers, respectively, it becomes possible to maintain the pressure toward the platen even when the recording medium leaves the carrier roller unit.

[0059] The structure is arranged so that with the establishment of the standard position for carrying a medium to align one edge portion of a recording medium to be used for a recording apparatus, the ribs are provided inside the other edge portion thereof by 1 mm to 10 mm, hence suppressing the edge portions from floating. Further, by positioning the nipping portions of the downstream side sheet exhaust roller unit on the extended lines of ribs, the floating suppression becomes more reliable.

[0060] Then, with the nipping portions of the sheet exhaust roller unit set on one and the same straight lines of ribs in the carrying direction of a recording medium, respectively, it becomes possible to carry the recording medium in the recording area without changing the corrugated condition or the irregularities formed by cockling.

[0061] Also, with the spurs of the sheet exhaust roller unit being arranged to be deviated from each rotational center of the sheet exhaust rollers, it becomes possible to obtain the pressure that may press a recording medium to the platen even after it leaves the carrier roller unit.

[0062] Further, with the sheet exhaust roller unit being arranged in two rows, it becomes possible to suppress the motion of the trailing end of a recording medium to float by reaction even when the leading end of the recording medium hangs down.

[0063] As described above, in accordance with the present invention, the floating of a recording medium from the platen can be suppressed to make the gap between the recording medium and recording means

narrower, hence making it possible to perform a high quality recording.

[0064] An ink jet recording apparatus, which records with deposition of ink droplets to a recording medium by use of ink jet recording means, comprises a platen for supporting a recording medium in a position facing ink jet recording means, a plurality of carrier roller pairs for nipping and carrying the recording medium to the position of ink deposition the recording medium using the ink jet recording means and extrusions extended in the carrying direction of the recording medium with respect to the platen, at the same time, being arranged in a plurality in the direction intersecting the carrying direction of the recording medium to support the reverse side of recording medium. Here, the carrier roller pairs are positioned on each of the extended lines of the extrusions on the upstream side of the carrying direction of the recording medium. With the structure thus arranged, the floating of a recording medium from the platen can be suppressed so as to allow the gap to be formed narrower between the recording medium and recording means, hence making it possible to perform recording in higher quality.

25 Claims

1. An ink jet recording apparatus for recording with deposition of ink droplets to a recording medium by use of ink jet recording means, comprising:

30 a platen for supporting a recording medium in a position facing ink jet recording means; a plurality of carrier roller pairs for nipping and carrying said recording medium to the position of ink deposition to said recording medium using said ink jet recording means; and extrusions extended in the carrying direction of said recording medium with respect to said platen, at the same time, being arranged in a plurality in the direction intersecting the carrying direction of said recording medium to support the reverse side of recording medium; said carrier roller pairs being positioned on each of the extended lines of said extrusions on the upstream side of the carrying direction of said recording medium.

40 2. An ink jet recording apparatus according to Claim 1, wherein said plurality of extrusions include the extrusions having different positions at each end thereof on the upstream side of the carrying direction of said recording medium, respectively.

45 3. An ink jet recording apparatus according to Claim 2, wherein said plurality of extrusions are arranged alternately with those having the end positions more on the upstream side in said carrying direction and not more than that therein.

4. An ink jet recording apparatus according to either one of Claim 1 to Claim 3, wherein the roller of said carrier roller pairs to be in contact with the surface of said recording medium having the deposition of ink droplets is arranged to be deviated from the facing roller thereof more on the downstream side in the carrying direction of said recording medium, and to nip and carry said recording medium while pressing the recording medium to said plurality of extrusions. 5

5. An ink jet recording apparatus according to Claim 4, wherein said ink jet recording means is an ink jet recording head for discharging ink by use of thermal energy. 10

6. An ink jet recording apparatus provided with a carrier roller unit having a plurality of roller pairs arranged on the upstream side of the recording area, and a platen arranged on the downstream side of said carrier roller unit for supporting a recording medium in a position facing recording means, comprising:
 the nipping portions of said carrier roller unit for nipping said recording medium by use of a plurality of said roller pairs thereof, and non-nipping portions; 25
 a plurality of ribs arranged for said platen, and positioned on the extended lines of said nipping portions in the carrying direction of said recording medium, and extended in the carrying direction of said recording medium;
 a standard position for carrying a recording medium capable of aligning one edge portion of said recording medium irrespective of the sizes of said recording medium, one of said plurality of ribs being arranged in a position inside the other edge of said recording apparatus of regular size by 1 mm to 10 mm. 30

7. An ink jet recording apparatus according to Claim 6, wherein said plurality of ribs are two kinds, longer ribs and shorter ribs, and said longer ribs and said shorter ribs are arranged alternately. 40

8. An ink jet recording apparatus according to Claim 6, wherein said carrier roller unit comprises carrier rollers, and driven rollers having the rotational center thereof in the position deviated on the downstream side from each rotational center of said carrier rollers to press said recording medium to said carrier rollers and said platen. 45

9. An ink jet recording apparatus according to either one of Claim 6 to claim 8, wherein said sheet exhaust roller unit for carrier said recording medium is arranged on the downstream side of said record- 50

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ing area, and said sheet exhaust roller unit comprises nipping portions for nipping said recording medium at least by a pair of rollers, and non-nipping portions, and each of said nipping portions of the exhaust roller unit is positioned substantially on the extended lines of said ribs in the carrying direction of said recording medium.

10. An ink jet recording apparatus according to Claim 9, wherein said sheet exhaust roller unit is arranged in two rows.

11. An ink jet recording apparatus according to Claim 10, wherein among said two sheet exhaust roller units, the number of rollers in said sheet exhaust roller unit on the downstream side is smaller than that of said sheet exhaust roller unit on the upstream side.

12. An ink jet recording apparatus according to Claim 9, wherein said sheet exhaust roller unit comprises sheet exhaust rollers, and driven rollers having the rotational center thereof in the position deviated on the downstream side from each rotational center of said sheet exhaust rollers to press said recording medium to said carrier rollers and said platen.

13. An ink jet recording apparatus according to Claim 9, wherein said sheet exhaust roller is divided into plural numbers in the direction substantially orthogonal to the carrying direction of said recording medium.

14. An ink jet recording apparatus according to Claim 6, wherein said recording means is an ink jet recording head for discharging ink by use of thermal energy.

FIG. 1

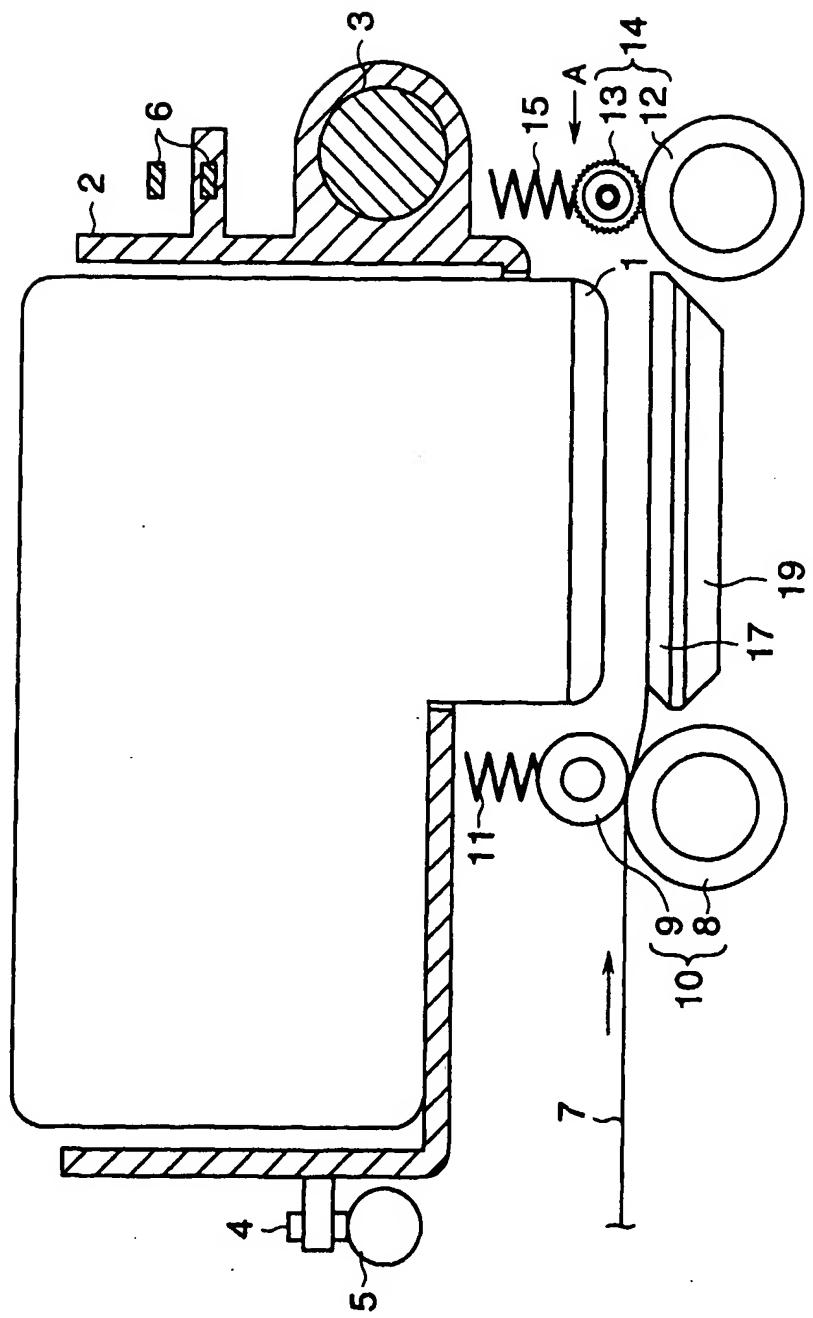


FIG.2

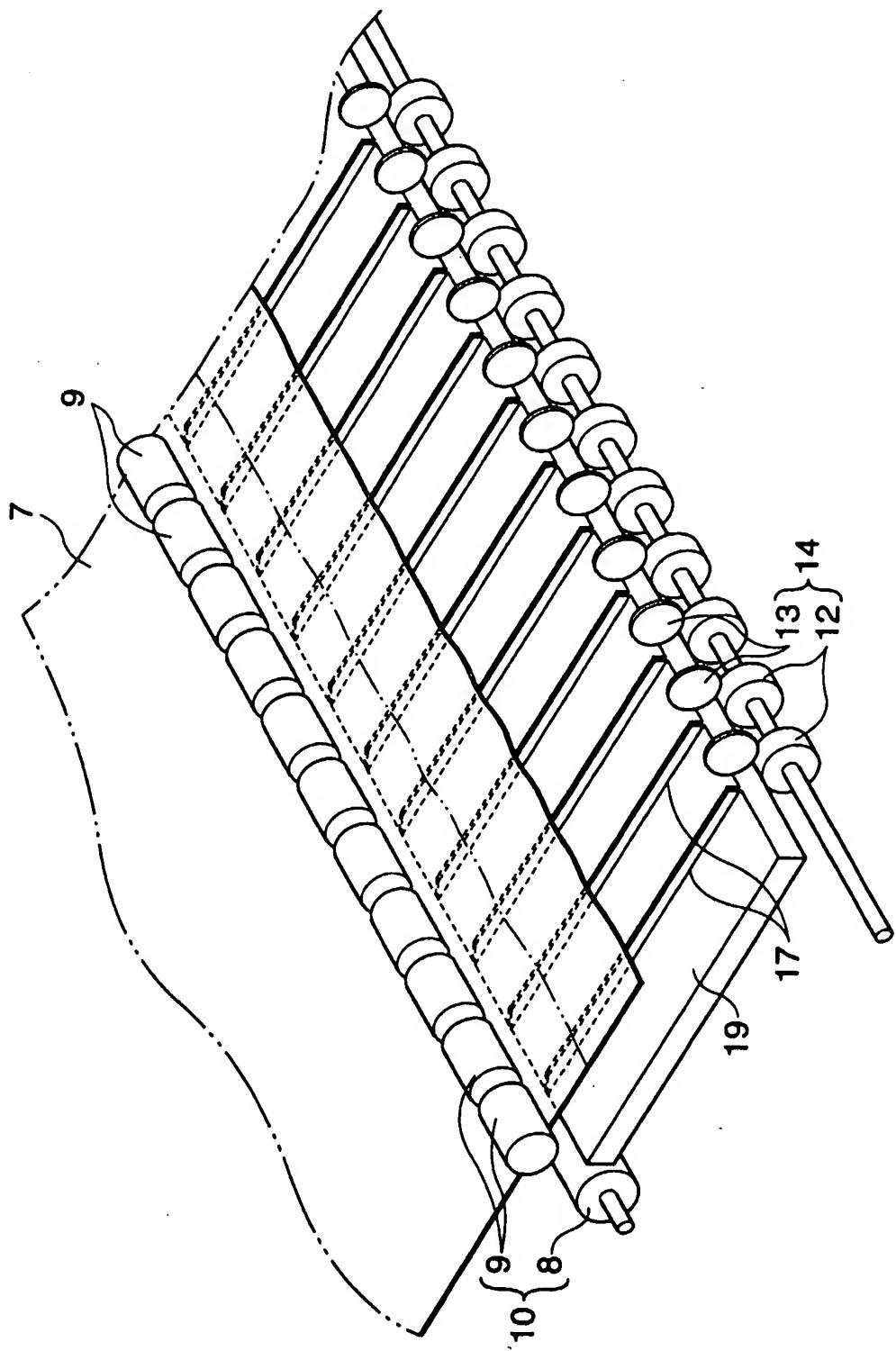


FIG.3

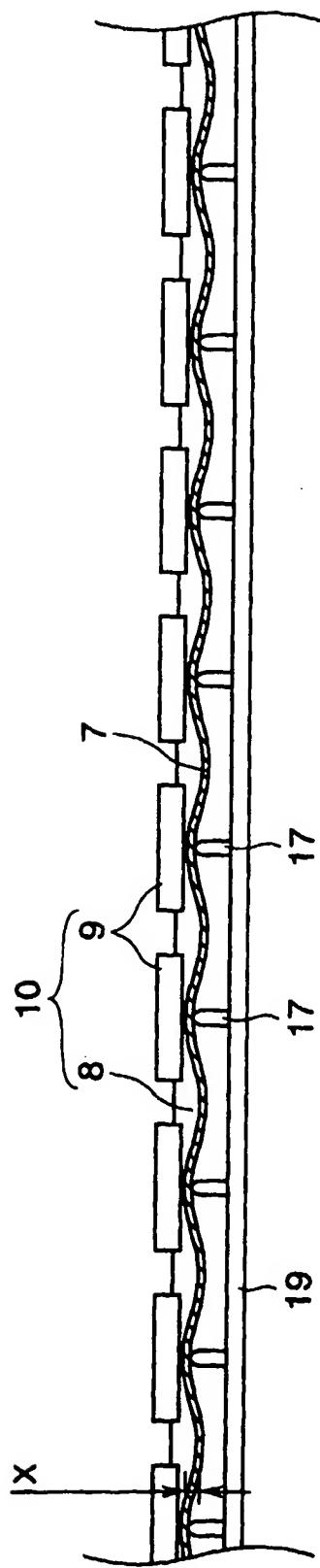


FIG.4

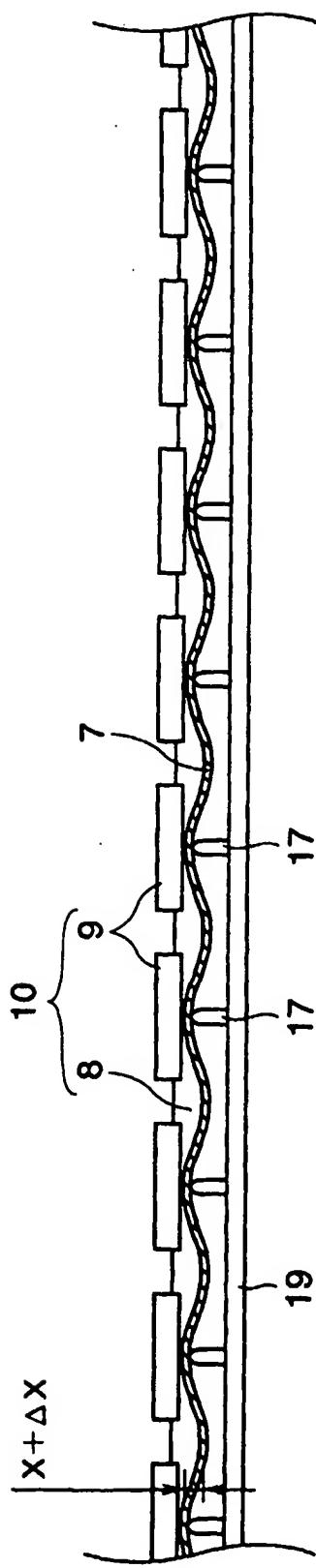


FIG. 5

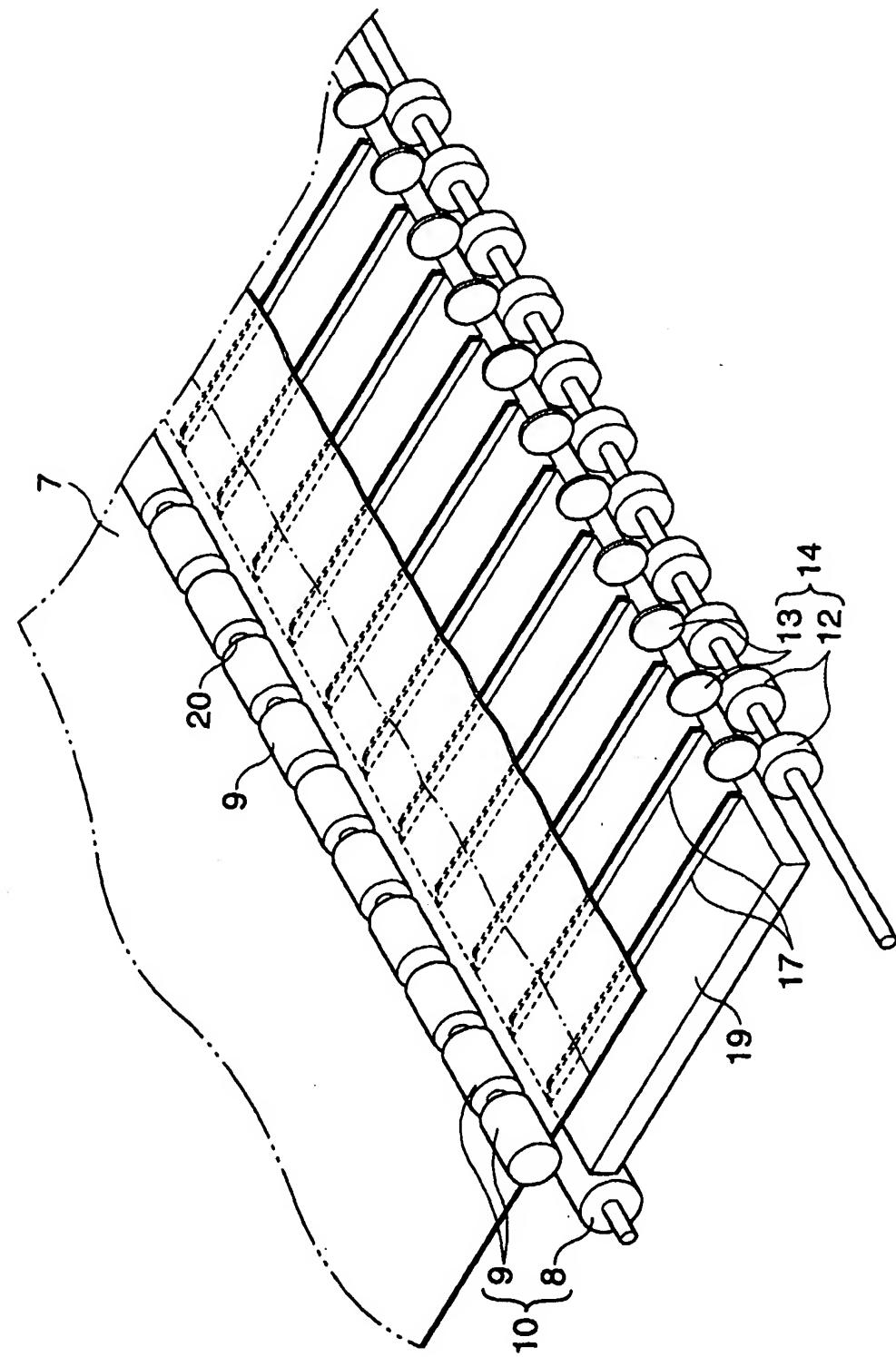
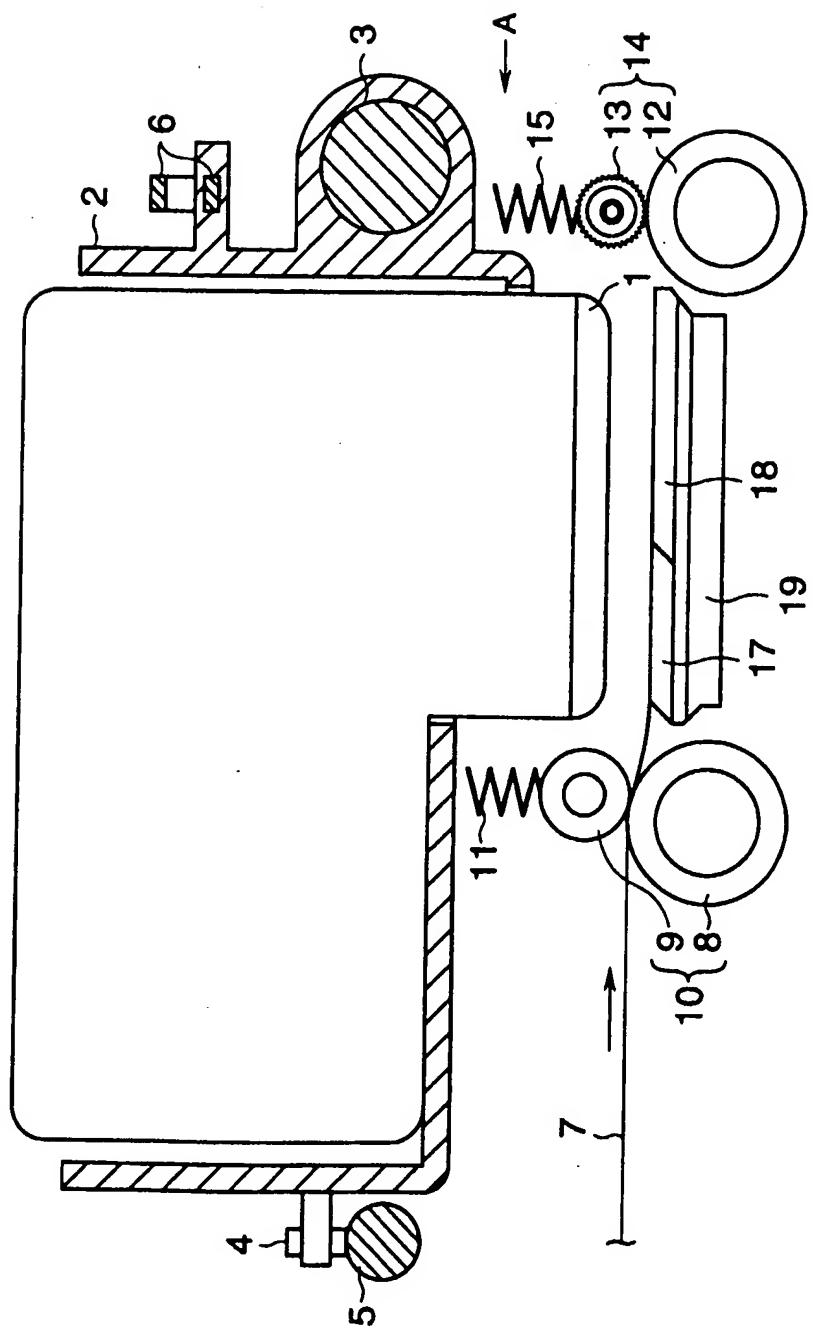


FIG.6



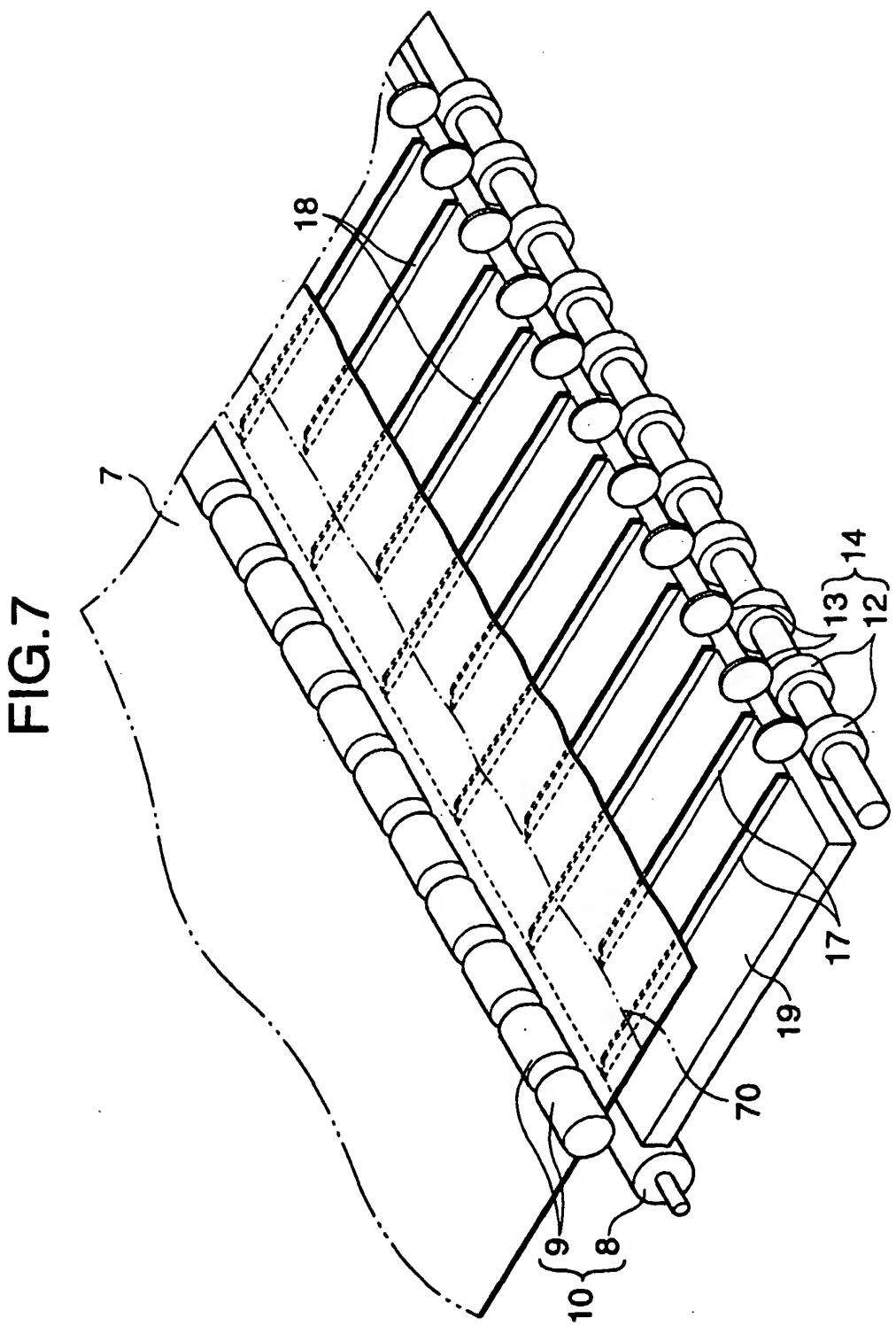


FIG.8

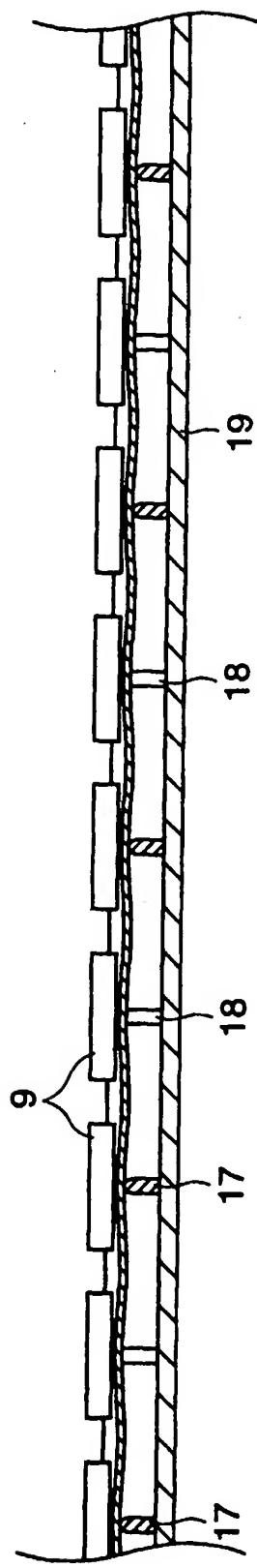


FIG.9

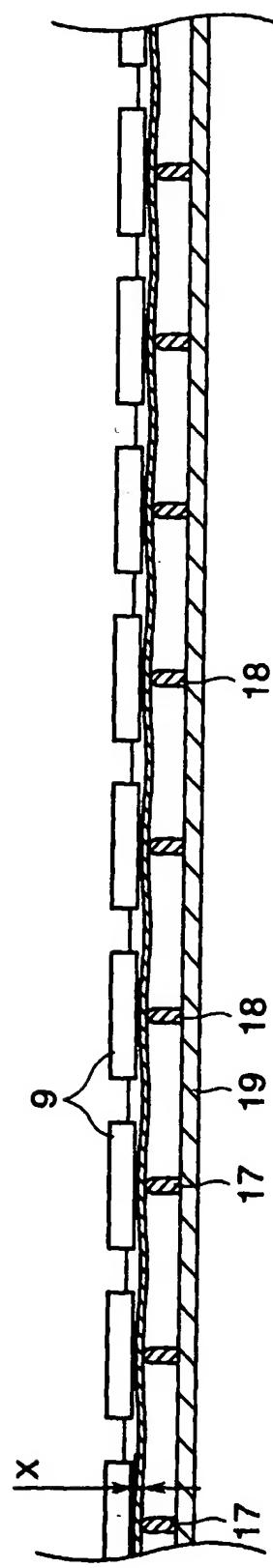


FIG.10

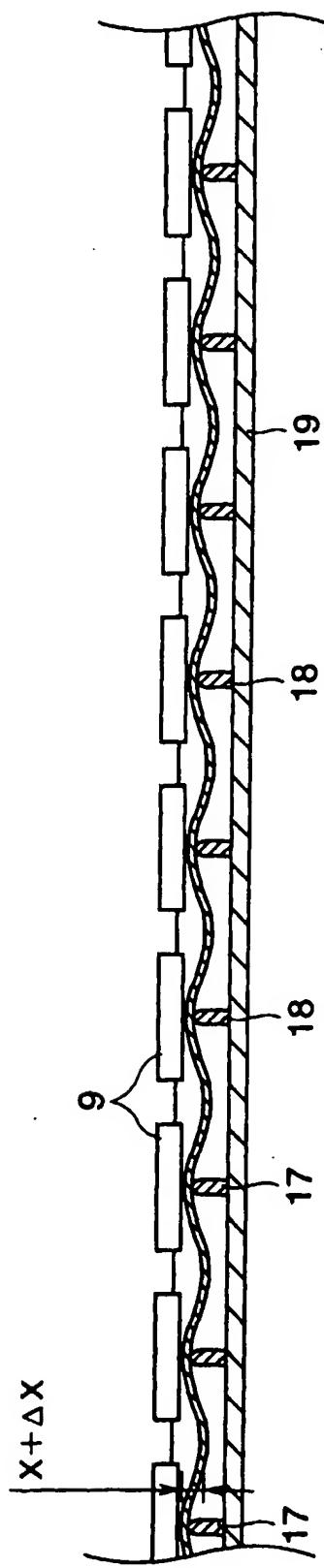


FIG. 1

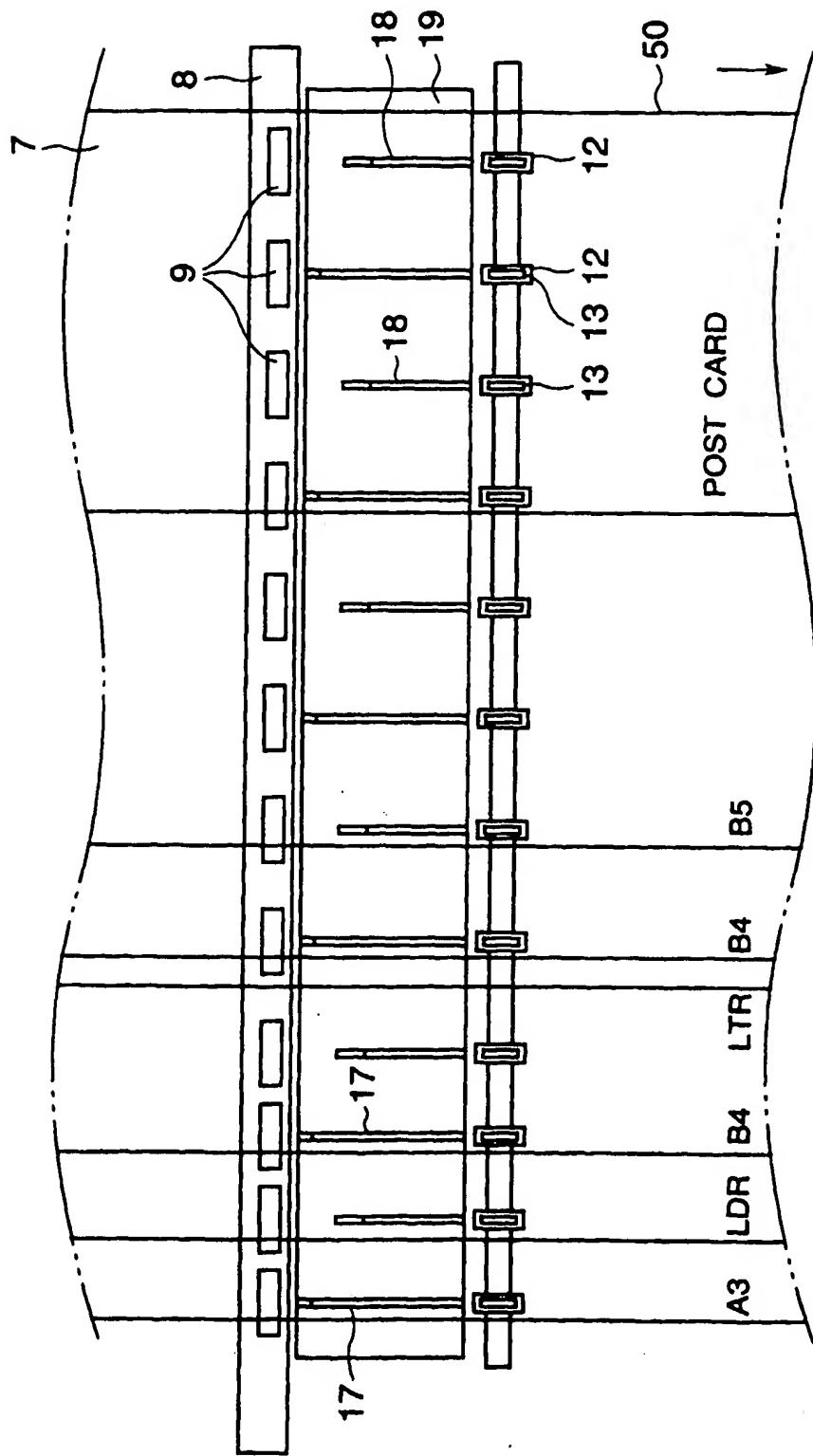


FIG. 12

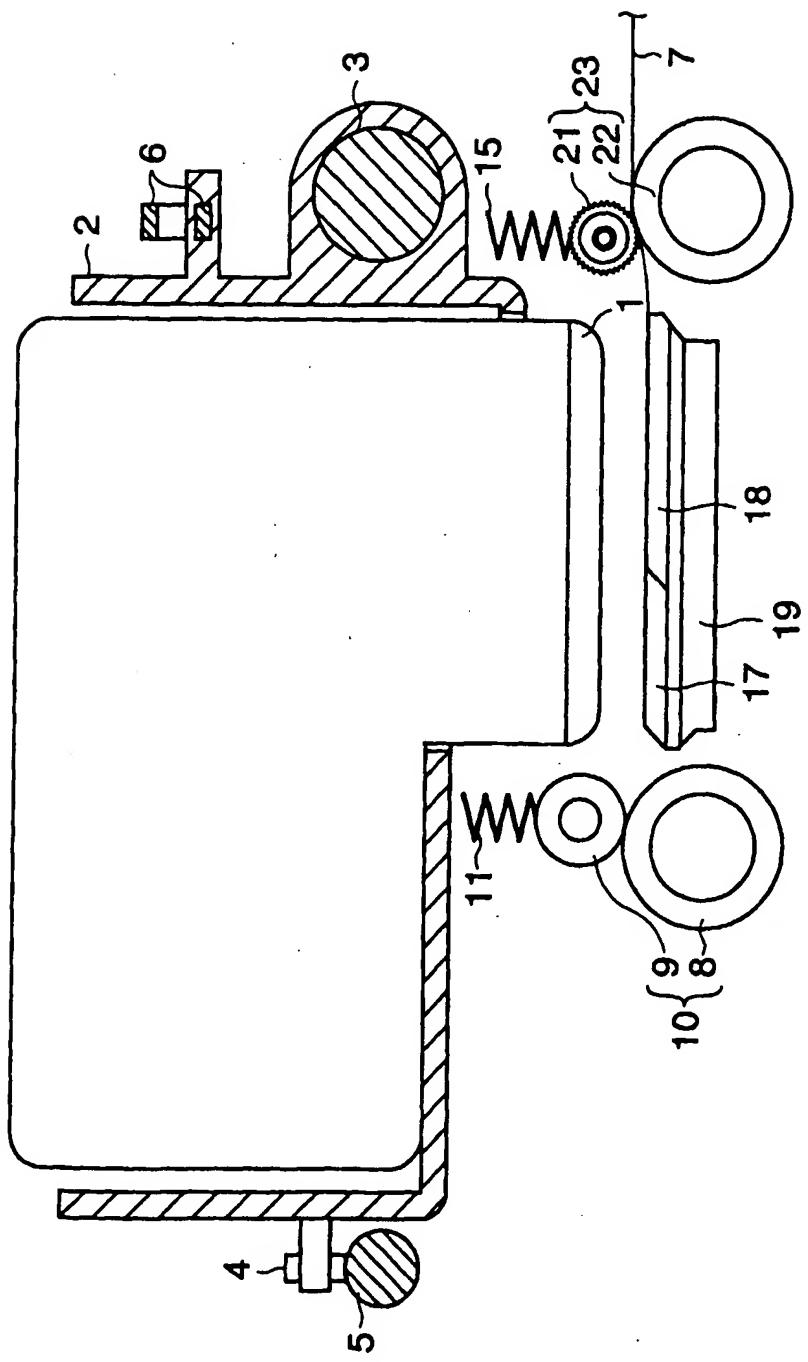


FIG.13

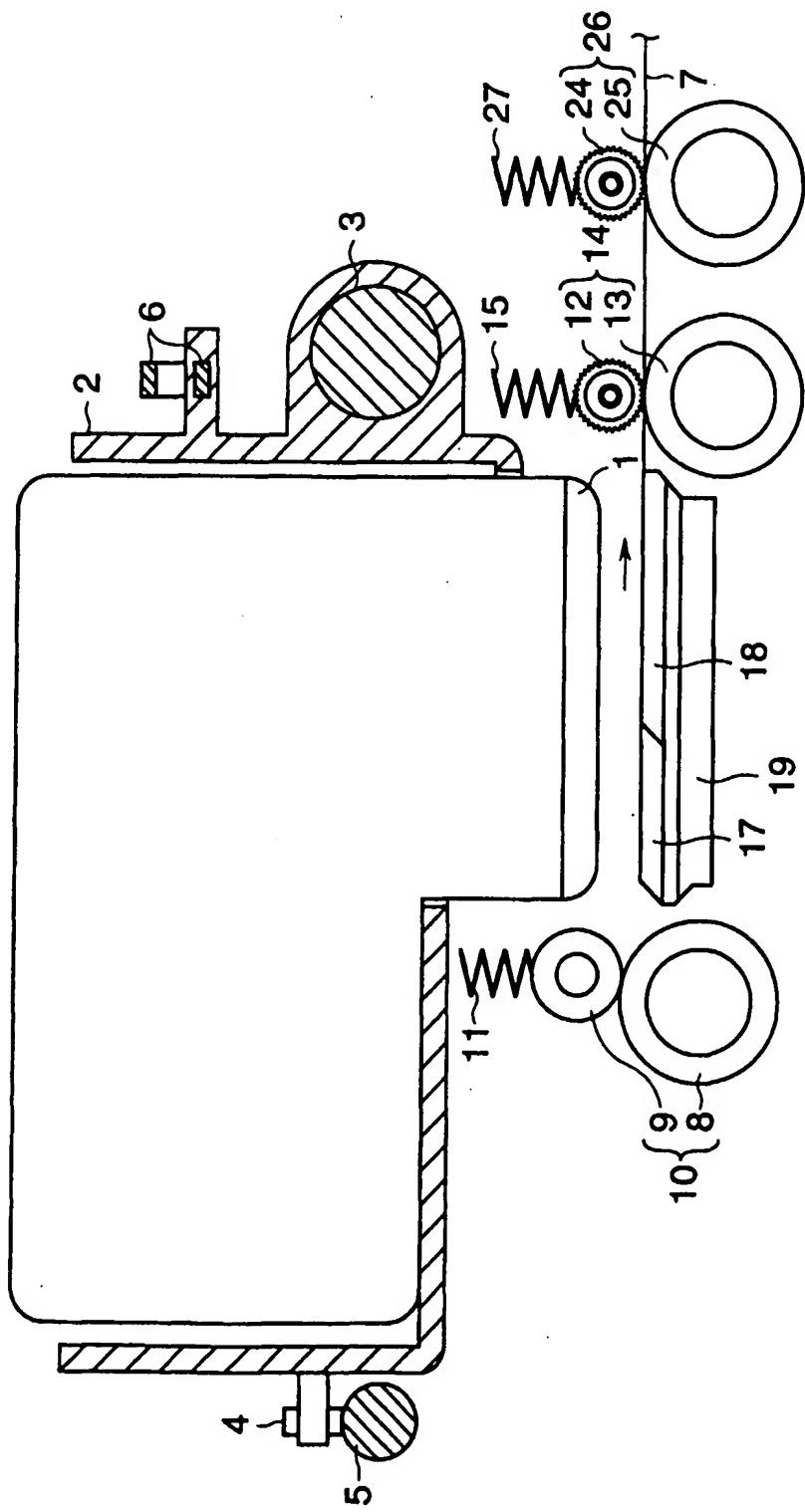


FIG.14

